MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

EME4196 – QUALITY ENGINEERING

(ME / RE / BE)

2 JUNE 2017
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of five pages (including cover page) with four questions.

2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

4. All necessary workings MUST be shown when applicable.

Question 1

a) Garvin (1988) has developed nine dimensions of quality that are widely accepted as being applicable to most products although these dimensions are somewhat independent.

i. Provide the meanings of these nine dimensions of quality.

ii. Discuss how Garvin's nine dimensions of quality can be applicable to a personal computer.

[9 + 9 marks]

b) Plan-Do-Check-Act (PDCA) was developed by Shewhart and it is now the operating principle of ISO's management system. Answer the following questions:

i. Illustrate and discuss each step in the PDCA.

ii. Who revised the PDCA into Plan-Do-Study-Act (PDSA) and what is the rationale behind the modification?

[5 + 2 marks]

Question 2

a) John, the manager of the printed-circuit-board-assembly line, feels overwhelmed by the number of defective units the factory has produced. As part of the methodology in identifying the major source of the problem, data in Table Q2 (a) are collected. Based on the data given, suggest a quality tool and draw a conclusion out of it. Show all the workings.

[6 marks]

Table Q2 (a) Data collected for the past 24 hours.

Defect	Number of defect occurrences
Components not adhering	143
Excess adhesive	71
Misplaced transistors	601
Defective board dimension	145
Mounting holes improperly positioned	12
Circuitry problems on final test	92
Wrong components	212

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Question 2 (continued)

b) Twelve samples, each containing five parts, were taken from a process that produces steel rods. The length of each rod in the samples was determined. The results were tabulated and sample means and ranges were computed as in Table Q2 i). Based on the data given in Table Q2 i) and Table Q2 ii), answer the following questions:

Table Q2 i)

Sample	Sample Mean (in.)	Range (in.)
1	10.002	0.011
2	10.002	0.014
3	9.991	0.007
4	10.006	0.022
5	9.997	0.013
6	9.999	0.012
7	10.001	0.008
8	10.005	0.013
9	9.995	0.004
10	10.001	0.011
11	10.001	0.014
12	10.006	0.009

Table Q2 ii)

n	Factor for $\overline{X}$ chart	Factors for R chart	
	A_2	D_3	D_4
2	1.88	0.00	3.27
3	1.02	0.00	2.57
4	0.73	0.00	2.28
5	0.58	0.00	2.11
6	0.48	0.00	2.00
7	0.42	0.08	1.92
8	0.37	0.14	1.86

i. Determine the upper and lower control limits for $\overline{X}$ - chart and R chart.

ii. Draw the charts and plot the values of the sample means and ranges.

iii. Based on the charts drawn in (ii), is the process in control? Explain.

iv. Explain, with at least two examples, what might cause a process to be out of control.

[10 + 4 + 2 + 3 marks]

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Question 3

a) Quality function deployment (QFD) was developed in Japan by Professor Yoji Akao.

i. What are the benefits of applying QFD as a quality tool?

ii. Consider the airline transportation industry. Develop a house of quality showing customer requirements and technical descriptors.

[3 + 4 marks]

b) The following system of components has been proposed for a new product where each component has a reliability of 0.90. Determine the reliability that the system will operate under each of these conditions:

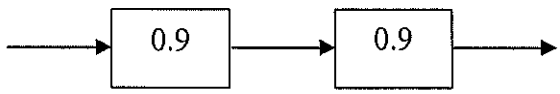

Figure Q3

i. The system as shown in Figure Q3.

ii. Each system component has a backup with a reliability of 0.90 and a switch that is 100 percent reliable.

iii. Each system component has a backup with a reliability of 0.982 and a switch that is 99 percent reliable.

[2 + 3 + 3 marks]

c) A machine is expected to operate for 200 hours after repair and the mean repair time is expected to be 2 hours. Answer the following questions:

i. What is availability and how can it be increased?

ii. Determine the availability of the machine.

iii. Determine the failure rate of the machine.

[4 + 3 + 3 marks]

Continued...

Question 4

a) Before any quality management efforts can be undertaken in an organization, top management needs a model for transformation. One possible model for transforming an organization is called the fork model. Explain how the fork model is used to represent the transformation of an organization.

[12 marks]

b) Different needs and situations stimulate an organization to pursue quality management. Give seven examples of aids that promote the transformation of an organization to quality management.

[7 marks]

c) As natural resources become scarce, discuss the roles of ISO 14000 in promoting good environmental management practices.

[6 marks]

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